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A Comparative Analysis Among Indian Commercial Banks (Public & Private) and a Foreign Bank Using Var (Value-At-Risk) Model

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Abstract
This research paper tries to assess the various types of risks prevalent in the banking sector using VaR (Value-at-Risk) model – a Risk assessment tool. As Value – at- Risk measures the probability that an asset is valued below a certain value during a particular time, a probabilistic approach is used to find the profitability. A comparative analysis is performed among the sample banks. Both the conventional methods and the new methods are used to evaluate the risk profile of the banks. The likelihood of occurrence of a particular value for an asset gives us the magnitude of risk involved in the corresponding asset of the bank. The VaR values which depend on market rates which are calculated for portfolios of various banks thus enabling us to differentiate various risk management practices prevalent among Indian Banks and a Foreign Bank. Factors which help in mitigating the risk are analyzed and their tolerance levels are put forth. Depending upon the confidence levels and considering worst case scenarios, financial institutions like banks are in constant search of tools to assess risk, which they might face in near future and to efficiently manage risk. This paper also provides an insight into the emerging risk management practices in the banking sector.
Keywords: Risk Management, Market Risk, VaR, Risk Assessment, Banking Sector, Banks, Risk, Diversifiable Risk, Non-Diversifiable Risk, The Great Depression
JEL Classification: M00,M1,C00,C1,C2,C3,C4,E00,E3,E4,E5,E65,F30

Introduction

The capital markets have rapidly diversified trading into different securities such as shares, commodities, debentures, mutual funds, derivative markets and so on. Banks also started to invest in these securities for high profitability. But the securities' value is widely influenced by market forces like interest rates, inflation and so on. The values of these securities fluctuate frequently, thus increasing the magnitude of risk involved. To sustain profitability and concurrently mitigate the level of risk involved, proper assessment of risk is essential. The Great Depression (1929) has made an assessment of risk inevitable. The main reason for this depression is mostly associated with the constant intervention of commercial activities in investing functions. The proper techniques to quantify the risk involved were not prevalent at that time. VaR emerged as a savior in measuring market risk.

The risk is mainly of two types. They are the systematic risk and unsystematic risk. Systematic risk arises from general market movements and hence cannot be diversified. It matters most for a diversified investor. This risk is also called as the Market Risk or the Non-Diversifiable risk. Unsystematic risk arises from company-specific factors and can be washed away through diversification. It is also called as the Diversifiable Risk or the Unique Risk. There are also other types of risk. They are credit risk or default risk, country risk, foreign exchange risk, interest rate risk, political risk and market risk.

Literature Review

The robustness of the Banking Sector is essential to ensure economic stability and growth (Halling and Hayden, 2006). Banks play a vital role in the financial sector contributing to the economic growth of the country and even execute importance on both sides of the balance sheet. On the liability side they provide loans, liquidity and on the assets side increases in the flow of funds (Diamond and Rajan, 1999).

The distinctive nature of the Bank exposes itself to liquidity risk, the risk which arises when Banks doesn't meet its obligations (Jenkinson, 2008) ; when customers demands his payment at any time, thus causing fire on sale of assets (Diamond and Rajan, 1999), negatively showing impact on the bank's profitability (Chaplin et al., 2000). Liquidity risk not only affects the performance of the Bank but also its reputation (Jenkinson, 2008). Over

the past few years, the Bank Managers didn't pay attention to the vital element of risk: the liquidity risk (Committee of European Banking Supervisors (CEBS, 2008). There are other risks faced by the Banks such as credit risk, operational risk and interest rate risk, which may eventually combine with liquidity risk (Brunnermeier and Yogo, 2009).

Credit risk is one of the greater concerns to the banking personnel's and also to the regulatory authorities like RBI (Reserve Bank of India), BIS (Bank for International Settlements) as credit risk is that category of risk which leads to the bank failure. Hence, credit risk management desires to be a robust process which enables Financial Institutions to proactively manage facility portfolios in order to minimize losses and earn an acceptable level of return for the shareholders (Dandago and Rufai, 2010). Credit risk management is a structured approach adopted to manage uncertainties through risk assessment, developing strategies to manage risk, and mitigate risk using the managerial resources (Nnanna, 2004). The risk management strategies include transferring of risk to another party, controlling the risk, reducing the repercussion of a particular risk. The primary objective of risk management is to trim down the effects of various kinds of risks prevalent in the Banking Sector.

In order to calculate market risk which the Bank is mostly affected by, the Value at Risk (VaR) method is used. Through this method, the Banks minimum capital needed to cover the risk is also estimated. In the evolution of risk management mechanism, VaR derives the relationship between the price and probability of unpredicted market motions, (Ioan and Annamária , 2009). The VaR considers the correlations among financial assets belonging to the portfolio and the advantage effect which further determines that both the market risk as well as the capital is needed to mitigate risk.

Research Gaps

There have been numerous studies relating to the Risk Management practices proficient in the Banking Sector. But very few studies have been done in the area of Market Risk and even those studies are unable to explain even a single methodology to calculate the VaR (Value at Risk) in detail. This research paper attempts to address these issues through Historical Stimulation method. The confidence level considered for different banks varied thus leading to uncertainty in comparison. In this paper, the same confidence level is considered as the basis for comparison for all the Banks.

a) Need for the Study:

The factors contributing to the operational risk, the market risk and the credit risk are steadily increasing, and these risks have to be mitigated with proper forecasting of the future risks involved. Statistical techniques were used to calculate the risk profile of the select sample Banks.

b) Reason for selecting the sample Banks:

The risk management techniques vary from bank to bank, be it Indian or Foreign. There is also a great deal of difference in adopting the risk management techniques between the Indian Public Sector Banks and the Indian Private Sector Banks. The comparative analysis would henceforth give the study a clear picture of how banks manage and mitigate risk associated with assets and portfolios thereafter.

c) The significance of the Study:

In this research, the Historical Simulation method, which is one of the simplest and appropriate methods to calculate VaR is used, as historical data is used to predict the future values.

d) The scope of the Study and the Rationale for the Study:

The scope of this research paper is limited to the Commercial Banks having the presence outside in India and the Foreign Banks operating in India as per the RBI's BASLE II guidelines.

e) Limitations of the Study:

The socio–political and economic factors may be varying from one country to another. The study is limited to select sample Banks i.e., Commercial Banks having the presence outside in India and Foreign Banks operating in India. This study doesn't generalize the scenario for all the Banks except the select sample Banks pertaining to the Study. The available information for the Foreign Banks is very limited and hence proper analysis could not be done for the aforesaid period of the study. The period of the concerned study is from 2013 to 2017.

f) Data Collection:

Historical Data regarding the amount of investment in each of the assets in the portfolios, return on investment for each of the assets and the prevailing market prices during the period of the study have been taken to calculate VaR (Value at Risk).

g) Sources of Data:

Secondary Sources have been used for the purpose of Data Collection. The study is a market research and is relied on secondary sources of data from respective bank's websites, regulatory body (RBI) website.

h)Period of the Study:

The period of the Study is limited to 5 (five) years for Indian Commercial Banks and one (1) year for the Foreign Bank.

Value At Risk (VaR)

Risk arises only when the value of security or asset varies from cost value. This is the main principle behind VaR. VaR measures the probability that the value of an asset will go down a precise value in a particular time. With a certain degree of confidence level, the risk involved is calculated by using the sample mean, standard deviation and variance.

According to Philippe Jorion (2002), "VaR measures the worst expected loss over a given horizon under normal market conditions at a given level of confidence".

VaR can be calculated using three methods. They are:

a) Delta-Normal Method
b) Monte Carlo simulation Method
c) Historical simulation Method

a)Delta-Normal Method: It is assumed that returns on all assets are normally distributed. This deals with the normal distribution where in we calculate variances and correlations for all the risk factors for a certain period. The composite linear exposure of the assets to many factors results in portfolio risk.

Drawback: Though this is the simplest method, the assumption of normal distribution of returns and inadequate risk measurement of nonlinear instruments like options, mortgages poses a problem.

b)Monte Carlo Method: It proceeds in two steps. In the first step, a stochastic process is observed by the risk manager for the financial variable and process parameters. Historical data is used to determine the risk and correlation parameters. In the second step, simulation mechanisms for variables of interest are assumed to have fictitious price paths.

Drawbacks:

Computational time is high as the number of simulations and probability distributions need to be estimated are high. This is not a cost-effective method.

c)Historical Simulation: This method is a well-known method for estimating VaR. In this method, historical data is used to predict future value. Using current portfolio weights and historical asset returns, we can generate hypothetical portfolios. This approach is called as "bootstrapping".

Advantages:

Relatively easy to apply if past data is readily available.

This method allows non-linearity and nonnormal distributions unlike Delta Normal method, by considering actual prices.

Disadvantages:

If historical data is unavailable or insufficient, forecasting is difficult.

Past may not always guide future values correctly. Thus resultant values may not reflect true values.

Flow Chart:

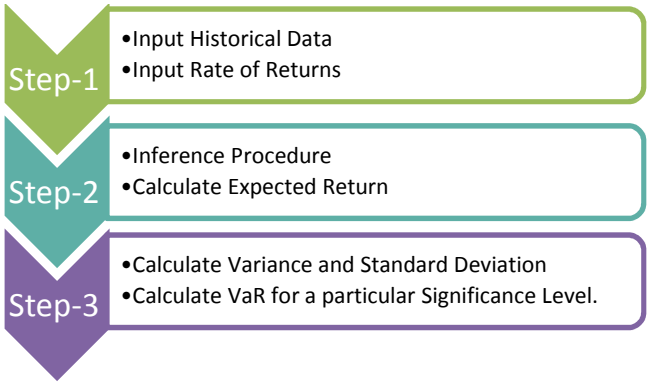

Fig.1: Flowchart of Historical Simulation **Source: Compiled by the Researcher**

Calculation of VaR:

In historical simulation method, mean, variance, standard deviation, error and confidence levels determine the VaR value.

Expected Return: Expected Return is the summation of all the returns of portfolio multiplied with their respective probabilities for historical data.

$$E(r) = \sum_{i=1}^{n} Pi * Ri \qquad eq(1)$$

Where E(r) =expected rate of return, Pi=probability associated with return of ith outcome,
Ri= Return for the ith possible outcome and n= Number of outcomes.

Standard Deviation: This is the risk associated with the variability of returns on securities. It is denoted by the symbol **"σ"**

$$\sigma = \sqrt{\sum_{i=1}^{n} Pi * (Ri - E(r))^2} \qquad eq(2)$$

Variance: Variance is the square of the standard deviation.

$$\sigma 2 = \sum_{i=1}^{n} Pi * (Ri - E(r))^2 \qquad eq\ (3)$$

VaR Steps:

1. Collect historical data at least for a period of five years.
2. Find the rate of return R(i) for the assets in the portfolio.
3. The probabilities depend on the proportion of the asset in the portfolio.
4. Calculate the expected rate of return E(r) using the formula in equation (1).
5. Calculate the variance using the formula in equation (3).
6. Calculate the standard deviation using equation (2), which is the square root of the variance.
7. The confidence level of 95%, which is significance level of 5%, is set and percentile VaR is to be calculated accordingly.

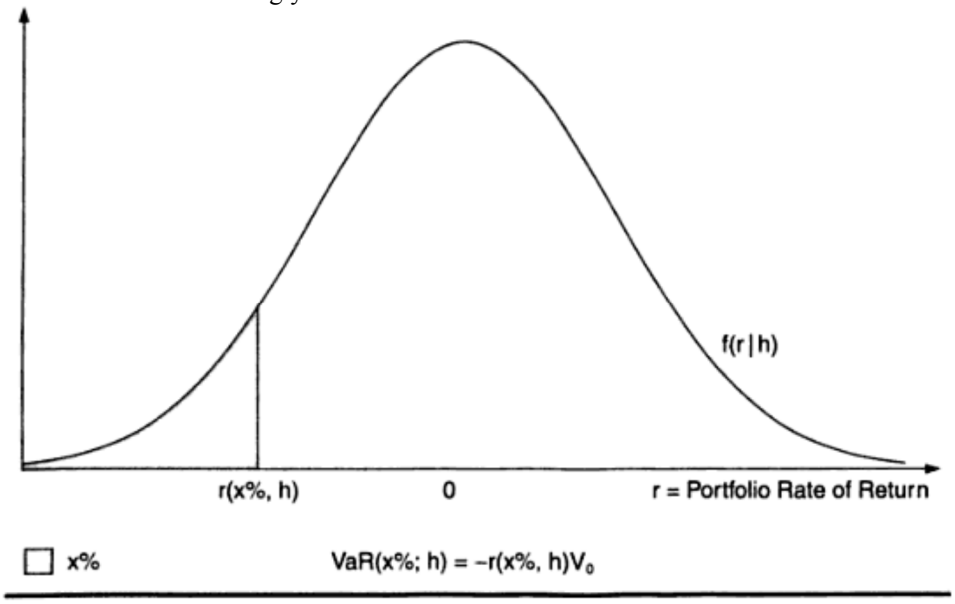

Fig.2: Normal Distribution **Source: Schwartz & Smith (1997, pp. 267)**

To change the portfolio returns into the normal distribution, the mean should be made equal to zero and the standard deviation equal to one.

The following formula is used to change into normal distribution:

Let 'z' be the value in normal distribution equivalent to corresponding the return of portfolio

$$z = (x - \mu)/\sigma$$

Where x= value of portfolio return, μ = mean value of portfolio returns for the period and
σ = Standard deviation of the portfolio returns.

Calculation of VaR for 5 (five) years:

The sample consists of 4 (four) Indian Banks and 2 (two) Foreign Banks. Of 4 (four) Indian Banks, 2 (two) correspond to Indian Public Sector Banks and other 2 (two) correspond to Indian Private Sector Banks.

a) Indian Banks

Indian banks can be further classified into Indian Public Sector Banks and Indian Private Sector Banks. The risk management techniques differ among the sample banks. Two (2) Banks from Indian Public Sector and two (2) banks from Indian Private Sector are considered for this Study.

Public Sector:

i) State Bank of India (SBI)

Instrument Type	CRISIL Rating
Perpetual Tier I Bonds	CRISIL AAA
Upper Tier II Bonds	CRISIL AAA
Lower Tier III Bonds	CRISIL AAA
Tier II Bonds(Under Basel III)	CRISIL AAA
Fixed Deposits	F AAA
Certificate of Deposit	CRISIL A1+

Table.1: Compiled by the Researcher **Source: www.crisil.com**

ii) State Bank of Hyderabad (SBH)

Instrument Type	CRISIL Rating
Perpetual Tier I Bonds	CRISIL AAA
Upper Tier II Bonds	CRISIL AAA

Table.2: Compiled by the Researcher **Source: www.crisil.com**

Comparison

PUBLIC SECTOR	2013	2014	2015	2016	2017
State Bank of India (SBI)	-44.22%	-15.26%	-12.34%	-26.62%	-18.22%
State Bank of Hyderabad (SBH)	-46.44%	-20.22%	-25.55%	-109.60%	-50.26%

Table.3: VaR value for a period of 5 years (Indian Banks-Public).
Source: Compiled from Risk Management Data of the Indian Banks

Private Sector

In private sector, the following banks are considered for analysis.

i) ICICI Bank Limited

Instrument Type	CRISIL Rating
Upper Tier II Bonds	CRISIL AAA
Perpetual Tier I Bonds	CRISIL AAA
Bond	CRISIL AAA
Pass-Through Certificate	CRISIL A1+(SO)
Pass-Through Certificate	CRISIL AAA(SO)
Structured Debt Obligation	CRISIL AAA(SO)
Notes	CRISIL AAA(SO)
Structured Debt Obligation	CRISIL BBB(SO)
Structured Debt Obligation	CRISIL BBB+(SO)

Table.4: Compiled by the Researcher **Source: www.crisil.com**

ii) Axis Bank

Instrument Type	CRISIL Rating
Certificate of Deposit	CRISIL A1+
Pass-Through Certificate	CRISIL A1+(SO)

Table.5: Compiled by the Researcher **Source: www.crisil.com**

Comparison

The VaR values for the banks are found to be as follows:

PRIVATE BANKS	2013	2014	2015	2016	2017
ICICI Bank	-158.29%	-13.60%	-26.41%	-87.87%	-53.73%
Axis Bank	-149.12%	37.19%	-23.64%	-93.21%	-68.09%

Table.6: VaR value for a period of 5 years (Indian Banks-Private)
Source: Compiled by the Researcher

CRISIL Rating Scale for Long-Term Instruments:

CRISIL AAA (Highest Safety)	Instruments with this rating are considered to have the highest degree of safety regarding timely servicing of financial obligations. Such instruments carry lowest credit risk.
CRISIL AA (High Safety)	Instruments with this rating are considered to have a high degree of safety regarding timely servicing of financial obligations. Such instruments carry very low credit risk.
CRISIL A (Adequate Safety)	Instruments with this rating are considered to have an adequate degree of safety regarding timely servicing of financial obligations. Such instruments carry low credit risk.
CRISIL BBB (Moderate Safety)	Instruments with this rating are considered to have a moderate degree of safety regarding timely servicing of financial obligations. Such instruments carry moderate credit risk.
CRISIL BB (Moderate Risk)	Instruments with this rating are considered to have a moderate risk of default regarding timely servicing of financial obligations.
CRISIL B (High Risk)	Instruments with this rating are considered to have a high risk of default regarding timely servicing of financial obligations.
CRISIL C (Very High Risk)	Instruments with this rating are considered to have very high risk of default regarding timely servicing of financial obligations.
CRISIL D (Default)	Instruments with this rating are in default or are expected to be in default soon.

Table.7: Compiled by Researcher **Source: www.crisil.com**

Foreign Bank

Hong Kong and Shanghai Banking Corporation (HSBC)-Asia (Hong Kong)

Instrument Type	S&P Rating
Long Term/Senior	AA-
Short Term	A-1+
LongTerm/senior	AA-
Short Term	A-1+

Table.8: Compiled by the Researcher **Source: https://www.hsbc.com.hk**

S&P Rating Scale

AAA	Extremely strong capacity to meet financial commitments. Highest Rating.
AA	Very strong capacity to meet financial commitments.
A	Strong capacity to meet financial commitments, but somewhat susceptible to adverse economic conditions and changes in circumstances.
BBB	Adequate capacity to meet financial commitments, but more subject to adverse economic conditions.
BBB-	Considered lowest investment grade by market participants.
BB+	Considered highest speculative grade by market participants.
BB	Less vulnerable in the near-term but faces major ongoing uncertainties to adverse business, financial and economic conditions.
B	More vulnerable to adverse business, financial and economic conditions but currently has the capacity to meet financial commitments.
CCC	Currently vulnerable and dependent on favorable business, financial and economic conditions to meet financial commitments.
CC	Currently highly vulnerable.
C	Currently highly vulnerable obligations and other defined circumstances.
D	Payment default on financial commitments.

Note: Ratings from 'AA' to 'CCC' may be modified by the addition of a plus (+) or minus (-) sign to show relative standing within the major rating categories.

Table.9: Compiled by the Researcher **Source: www.standardandpoors.com**

Comparison of VaR values between Indian Banks and the Foreign Bank:

In this, VaR values of Indian banks both public and private sectors are compared with HSBC Bank.

Year	State Bank of India	State Bank of Hyderabad	Axis Bank	ICICI Bank	HSBC
2017	-18.22%	-50.26%	-68.09%	-53.73%	-30%

Table.10: VaR values for the year 2017. Source: Compiled by the Researcher

Data Analysis:

The following graph shows the relative increase in the VaR value for public sector banks in India.

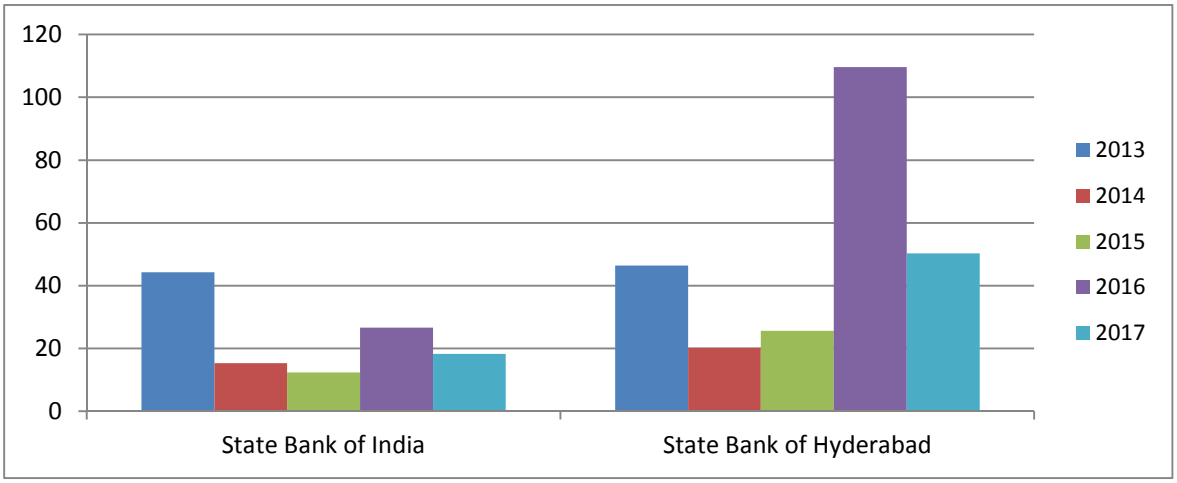

Fig.3: VaR value for 5 years for Public Sector Banks. Source: Compiled.

From the graph, it is evident that State Bank of India (SBI) reduced its Value at Risk (VaR) significantly from the year 2013 to the year 2017. But for State Bank of Hyderabad, the VaR is maximum in the year 2016 and is little higher when compared to the year 2013. The risk-mitigating techniques used by State Bank of India are comparatively very effective than the techniques used by the State Bank of Hyderabad.

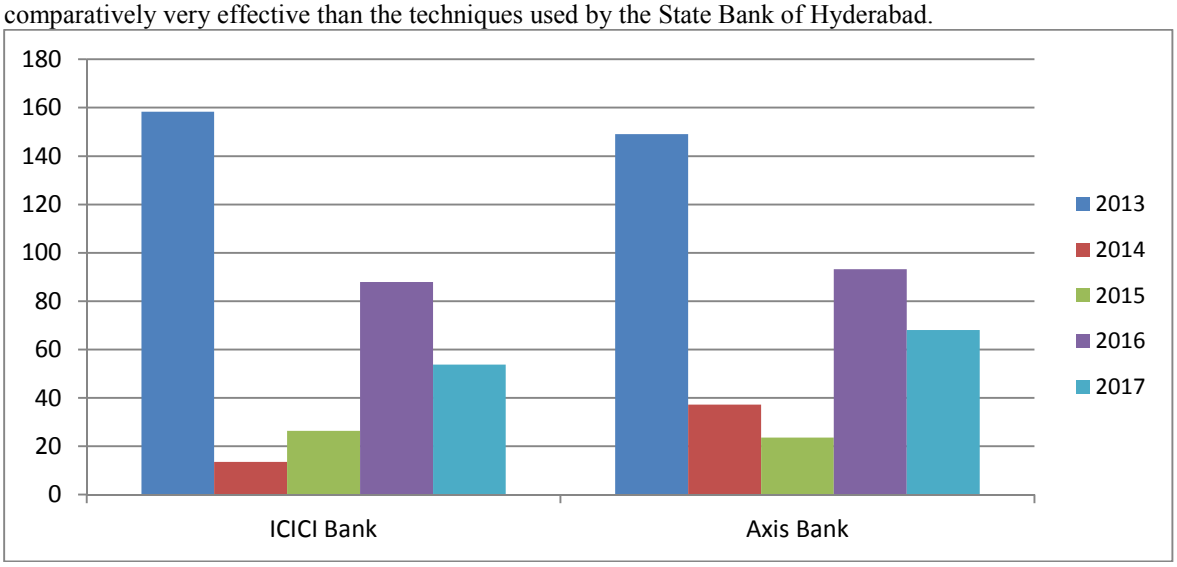

Fig.4: VaR values for a period of 5 years (Private Banks) Source: Compiled.

From the graph, the value at risk for both ICICI Bank and Axis Bank are comparatively very high in 2013 and 2016. But ICICI Bank seems to have made an effort to reduce risk in 2014, 2015 and 2017. ICICI Bank has maintained equal or less value at risk when compared with Axis Bank.

Comparison of a Foreign Bank with Indian Banks (both Public Sector and Private Sector):
The following graph shows the value at risk values for all the banks that are public, private and a foreign bank in the year 2017.

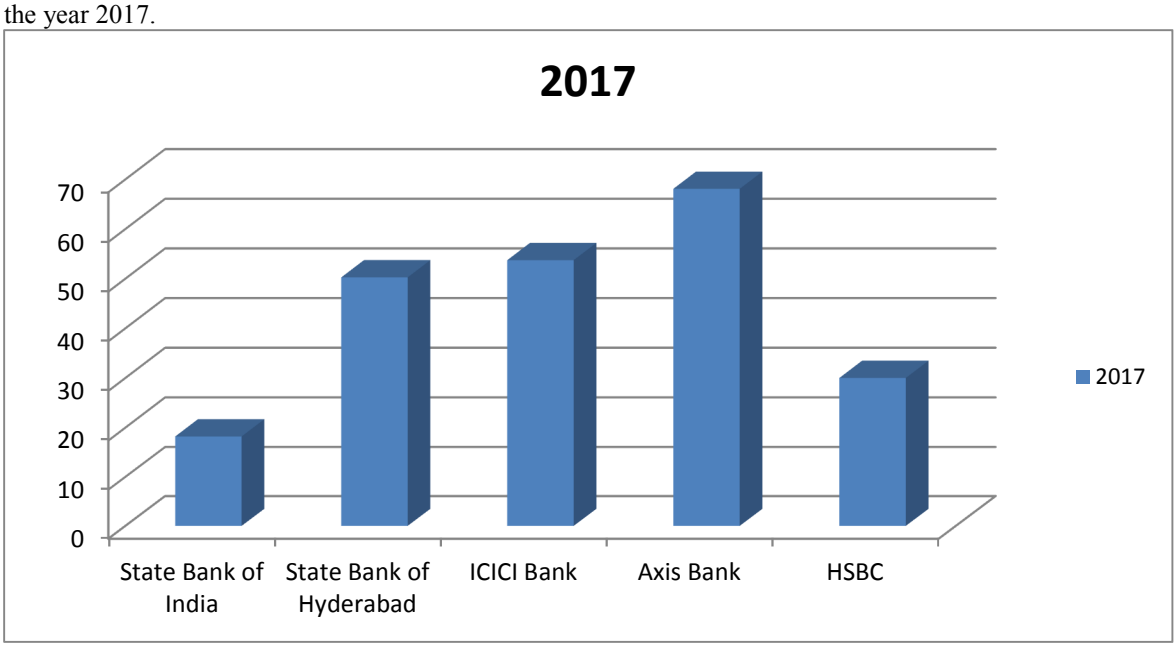

Fig.5: VaR values of different banks in the year 2017. **Source: Compiled.**

From the above graph, it is evident that state bank of India has relatively maintained low value at risk. Second in line is HSBC, then State Bank of Hyderabad, ICICI Bank and Axis Bank. Of all the banks, state bank of India seems to have used effective risk management techniques when compared to other banks.

Discussion of Results:
All through the five and also in the year 2017, State bank of India (SBI) has maintained very low Value at Risk. SBI has got 5 associate banks which operate throughout India including in 190 foreign countries having 17000 branches spread ubiquitously. The Government of India (GoI) owns 62% stake of SBI, being the promoter. SBI is supposed to be one of the loyal, esteemed Bank of India which won hearts of many Indian customers. Both the customers and bank are credible to each other, building affinity among them hence reducing the risk involved and the VaR as it gives loans only to the esteemed customers with due diligence and maintaining a good relationship.

Conclusions for the Study:
There are different VaR tools like marginal VaR, incremental VaR, component VaR which are useful for risk management. These tools can be used to diversify the portfolio and thus can reduce the risk encountered. Different banks VaR values are calculated and compared. From the results, it can be seen that VaR values fluctuate through the years from 2013 to 2017. State Bank of India comparatively managed risk effectively.

Suggestions pertaining to the Study:
Efficient Risk Management techniques should be used in order to mitigate risk. For this, assessment of risk is necessary. This assessment can be done using VaR values. But VaR alone is not sufficient to assess risk totally. Other techniques should be used to supplement VaR tool. Though VaR is simple to use, it does not take all the factors into consideration. Supplementary techniques like stress testing can be used.

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